wellcome
centre
human
neuroimaging

From raw MEG/EEG to publication

frontiers special topic featuring

open analyses of open data

Vladimir Litvak

> “Nothing is more powerful than an idea whose time has come.”

Victor Hugo

The idea

- Peer-reviewed and citable repository of open group analyses of open data.
- Reviewers are asked to reproduce the analysis in full.
- Ensure persistence for at least 10 years.
- Six major open source toolboxes (Brainstorm, EEGLAB, FieldTrip, MNE-Python, NutMEG, SPM) promised to contribute analyses of the same dataset.

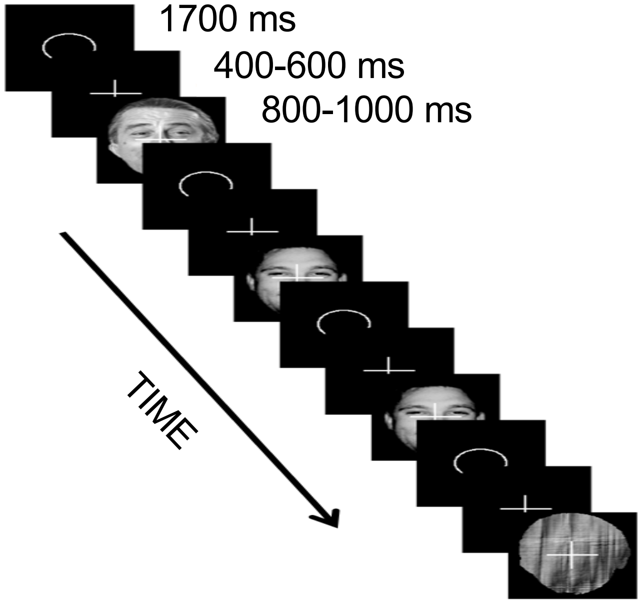
Current state of the project

- Frontiers in Neuroscience: Brain Imaging Methods special topic was advertised in Oct, 2016
- The official submission deadline was Jan 10, 2018
- 20 papers were submitted, 17 of them are published
- Still awaiting submissions from some of the previously registered groups

Special thanks

Rik Henson – Cambridge

- Acquired and published the multimodal faces dataset (with Daniel Wakeman).
- Wrote the SPM manual chapter which inspired the special topic idea.
- Made great efforts to convert the faces dataset to BIDS and adapt to the special topic’s needs and OpenNeuro requirements.
- Is the main contributor and first author of the SPM submission.



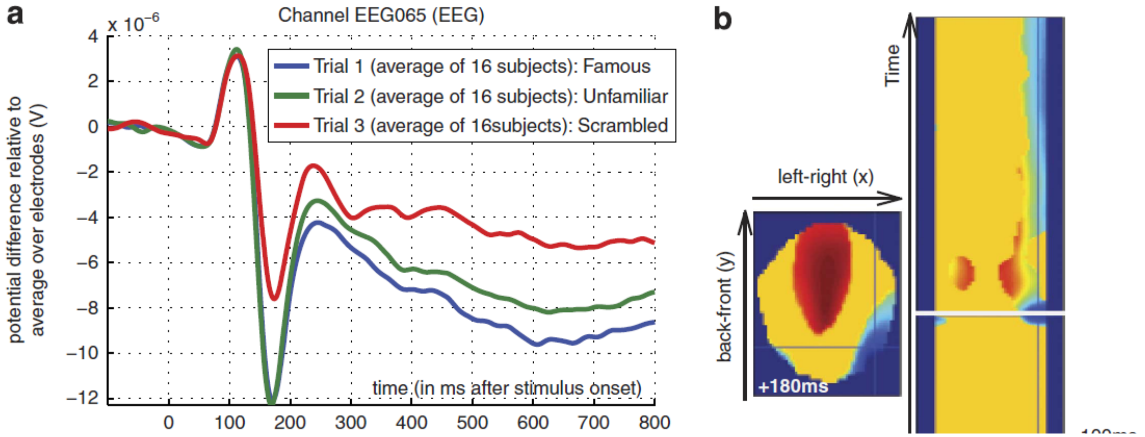
N=16 Subjects

EEG = 70 channels, nose-reference (concurrent with MEG)
MEG = 102 magnetometers + 204 planar gradiometers

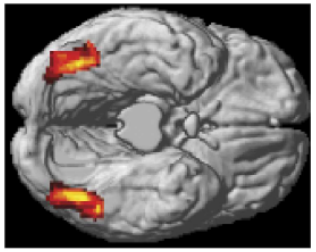
fMRI = BOLD EPI 3x3x3mm (3T Siemens Trio)
MRI = T1 MPRAGE 1x1x1mm

Stimuli: 3 types of greyscale face images:
- 300 x Famous
- 300 x Unfamiliar (previously unseen)
- 300 x Phase-scrambled versions of above

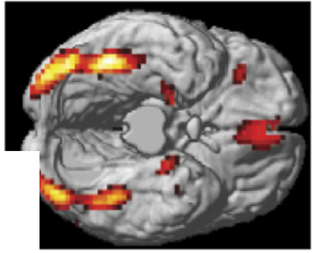
Task: Judge left-right symmetry



M/EEG



fMRI



Wakeman & Henson (2015), *Scientific Data*
http://www.nature.com/articles/sdata20151
Contact: dwakeman@nmr.mgh.harvard.edu rik.henson@mrc-cbu.cam.ac.uk

Andrew J. Quinn, Diego Vidaurre, Romesh Abeysuriya, Robert Becker, Anna C. Nobre and Mark W. Woolrich
Task-Evoked Dynamic Network Analysis Through Hidden Markov Modeling

Marijn van Vliet, Mia Liljeström, Susanna Aro, Riitta Salmelin and Jan Kujala
Analysis of functional connectivity and oscillatory power using DICS: from raw MEG data to group-level statistics in Python

Mainak Jas, Eric Larson, Denis A. Engemann, Jaakko Leppäkangas, Samu Taulu, Matti Hämäläinen and Alexandre Gramfort
A Reproducible MEG/EEG Group Study With the MNE Software: Recommendations, Quality Assessments, and Good Practices

Jinbiao Yang, Hao Zhu and Xing Tian
Group-Level Multivariate Analysis in EasyEEG Toolbox: Examining the Temporal Dynamics Using Topographic Responses

Johannes J. Fahrenfort, Joram van Driel, Simon van Gaal and Christian N. L. Olivers
From ERPs to MVPA Using the Amsterdam Decoding and Modeling Toolbox (ADAM)

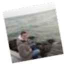
MNE MEG + EEG ANALYSIS & VISUALIZATION ✓ Published
FieldTrip Under review*
Brainstorm In preparation
12 Under review
EEGLAB In preparation
NUTMEG In preparation

12 papers used other datasets

Cecilia Jobst, Paul Ferrari, Silvia Isabella and Douglas Cheyne BrainWave: A Matlab Toolbox for Beamformer Source Analysis of MEG Data	Standard “Go/No-go” version of the sustained attention to response task (SART) – 12 subjects - MEG
Clare Diane Harris, Elise Rowe, Roshini Randeniya and Marta I. Garrido Bayesian Model Selection Maps for group studies using M/EEG data	Auditory oddball – 12 subjects - EEG
April R. Levin, Adriana S. Méndez Leal, Laurel J. Gabard-Durnam and Heather M. O’Leary BEAPP: The Batch Electroencephalography Automated Processing Platform	Resting state and auditory oddball – 10 infants - EEG
Marie Habermann, Dorothea Weusmann, Maria Stein and Thomas Koenig A Student's Guide to Randomization Statistics for Multichannel Event-Related Potentials Using Ragu	Language learning task – 16 subjects EEG
Stavros I. Dimitriadis, María E. López, Ricardo Bruña, Pablo Cuesta, Alberto Marcos, Fernando Maestú and Ernesto Pereda How to Build a Functional Connectomic Biomarker for Mild Cognitive Impairment From Source Reconstructed MEG Resting-State Activity: The Combination of ROI Representation and Connectivity Estimator Matters	Resting state – 24 subjects with MCI - MEG
Maren Stropahl, Anna-Katharina R. Bauer, Stefan Debener and Martin G. Bleichner Source-Modeling Auditory Processes of EEG Data Using EEGLAB and Brainstorm	Auditory narrow band noise – 10 subjects - EEG

Lau M. Andersen Group Analysis in FieldTrip of Time-Frequency Responses: A Pipeline for Reproducibility at Every Step of Processing, Going From Individual Sensor Space Representations to an Across-Group Source Space Representation	Rhythmic tactile stimulation – 20 subjects MEG
Lau M. Andersen Group Analysis in MNE-Python of Evoked Responses from a Tactile Stimulation Paradigm: A Pipeline for Reproducibility at Every Step of Processing, Going from Individual Sensor Space Representations to an across-Group Source Space Representation	Rhythmic tactile stimulation – 20 subjects MEG
Benjamin U. Cowley and Jussi Korpela Computational Testing for Automated Preprocessing 2: Practical Demonstration of a System for Scientific Data-Processing Workflow Management for High-Volume EEG.	Auditory two-choice response task – 12 subjects EEG
Laurel J. Gabard-Durnam, Adriana S. Mendez Leal, Carol L. Wilkinson and April R. Levin The Harvard Automated Processing Pipeline for Electroencephalography (HAPPE): Standardized Processing Software for Developmental and High-Artifact Data	Resting state developmental – 10 subjects EEG
Romy Frömer, Martin Maier and Rasha Abdel Rahman Group-Level EEG-Processing Pipeline for Flexible Single Trial-Based Analyses Including Linear Mixed Models	Visual search task – 40 subjects EEG
Robert A. Seymour, Gina Rippon and Klaus Kessler The Detection of Phase Amplitude Coupling during Sensory Processing	Visual grating and auditory click – 16 subjects - MEG

Impact



Sam Cosper
@psyling_sam

As soon as this upcoming conference is over, I may just have to try this pipeline on my data. I'm still a bit skeptical, but if this corrects artifacts in infant data, it would save me (and others) lots of stress and disappointment!

04 Mar 2018

Peter Bachman
@NeRDlabPete

Yes, I want this pipeline now please!

27 Feb 2018

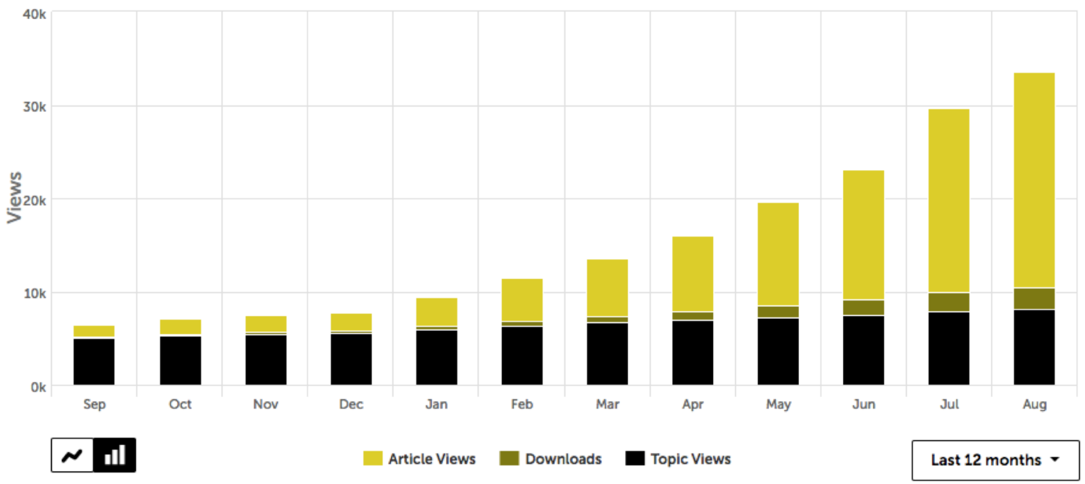
Jeff Johnson
@jeffmri

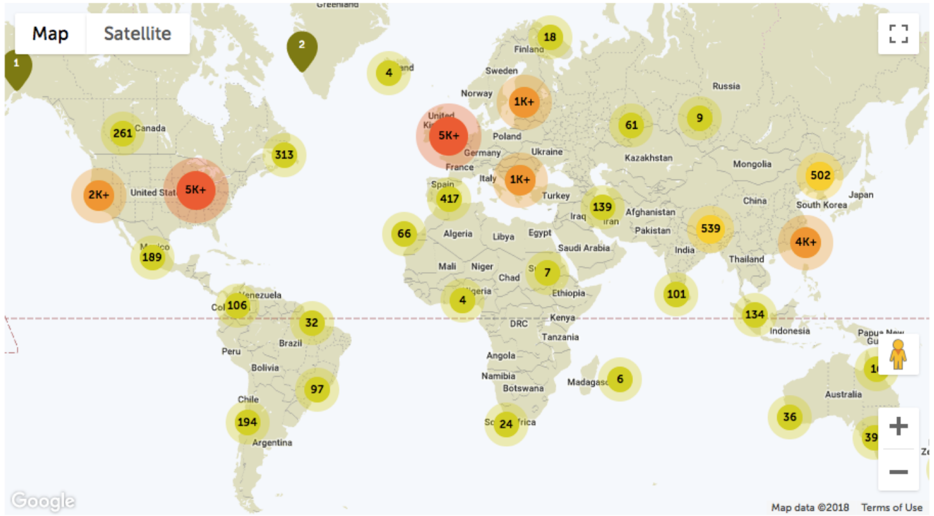
Some of the sweetest words I've read in a paper in recent memory: "The results section provides the code to run and plot the results...

09 Jul 2018

Last 12 months

33,554 total views **23,039** article views **2,431** article downloads **8,084** topic views





Steve Luck
@stevenjluck

Nice to see people publishing their processing pipelines so others can use them. A great next step would be to see how well a given pipeline recovers features of known sources (via simulations with ground truth).

09 May 2018

Next steps – towards robust and validated MEG analysis

- Comparison of results across toolboxes and benchmarking
- Scrutiny and critique of the published pipelines
- Application of new analyses to the topic datasets
- Application of topic analyses to new data

Special topic editors

Vladimir Litvak
London - SPM

Alexandre Gramfort
Paris – MNE

Arnaud Delorme
Tolouse, San Diego- EEGLAB

Robert Oostenveld
Nijmegen – FieldTrip

Francoise Tadel
Grenoble - Brainstorm

Srikantan S Nagarajan
San Francisco – NutMEG

Special topic reviewers

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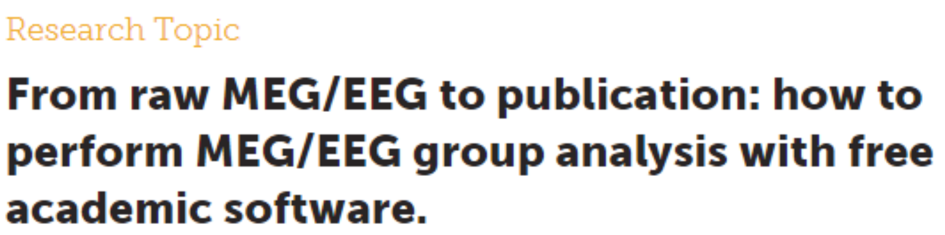

Research Topic

From raw MEG/EEG to publication: how to perform MEG/EEG group analysis with free academic software.

https://www.frontiersin.org/research-topics/5158/

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